Bugs & Diseases

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Alberta's eye on forest health

Issue highlights:

Forest Health and Adaptation

Alberta Government

A Good Year for Pine Needle Cast

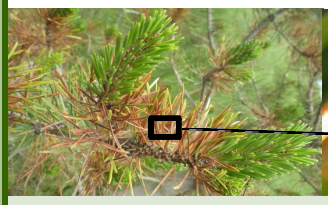
This past summer during our aerial overview surveys around 35,000 hectares of pine needle cast (PNC) was mapped across the province. Most of it was attributed to the fungal pathogen *Lophodermella concolor*. Defoliation, branch kill, and crown dieback are commonly the results of this needle disease[1]. Occasionally several years of infection can cause tree mortality. All two-needle pines are susceptible, as well as all ages[3].

Mature lodgepole pine stand with PNC

Young lodgepole pine stand with PNC

The disease cycle for L. concolor takes one year from needle infection the first summer, to spore production and loss of the infected needles in the following summer[1].

In the summer following infection, the affected needles begin to fade and turn red. Small oval-shaped fruiting bodies form on the needles. The red needles eventually turn a straw color and are 'cast' off the tree.[2]. The fruiting bodies release spores that land on the newly emerging needles, germinate and penetrate the needle surface. The fungus grows inside the newly emerging needles, leaving no outward sign that the needles are infected until the following year[3]. The newly infected needles remain green until the following spring when they begin to fade and spores are produced that infect the new year's emerging needles.



Needles turning red in spring.

Oval fruiting bodies developing.

Because previously infected needles are cast off, successive years of infection in a tree can result in only the current needles remaining on the tree giving the tree a 'lion's tail' appearance[2].

Young lodgepole pine with 'lions tail'

Wet summers can escalate this needle disease as moist conditions are more favorable for the survival and germination of the spores. If the disease persists for several years leader dieback, increment loss and even tree mortality can occur. Generally, mature trees are not as severely impacted as younger, shorter trees due to their upper crowns getting more wind, therefore, humidity levels are lower so only their mid to lower crowns are heavily infected and experience needle loss[3]. In the Rocky Mountain House Forest area we have seen this disease for the past two years and although this spring was very warm and dry the summer was very wet and dreary which has been very good for the survival and spread of this pine needle cast. We will need a warm, dry summer to break the disease cycle.

[1] Forestry Development. 2011. Common Tree Diseases of British Columbia. Pine Needle Cast (Web page): http://forestrydev.org/diseases/CTD/Group/Needle/needle4_e.html
[2] Natural Resource Canada. 2015. Pine Needle Cast (web page): https://tidcf.nrcan.gc.ca/en/diseases/factsheet/1000044
[3] Worrall JJ, Marchett SB, Mask RA. 2012. An Epidemic of Needle Cast on Lodgepole Pine in Colorado Biological Evaluation R2-12-01. USDA Forest Service, Rocky Mountain Region, Forest Health Protection, Gunnison, Colorado http://www.forestpathology.org/pdfs/12needlecast.pdf

Pam Melnick—Rocky Mtn. House Forest Area

Biocontrol Summary for 2016

Biological control releases made over the last 4 years are beginning to reap the benefits. At three of the releases in the south (Castle & Porcupine Hills), all of the target plants (hound's-tongue) within the release plot have been eradicated and the insects have moved to nearby plants. Collections of insects were made from these sites this past summer and released at other infestations.

The two scentless chamomile release sites (Whitecourt & Wandering River) are now showing significant declines in target plant cover. The Whitecourt site is nearly eradicated and a collection was made this year and released northeast of Peace River. Alberta Newsprint Company in the Whitecourt area has also begun using biocontrol for invasive plant infestations on their sites.

Releases on common toadflax of the stem-mining weevil have yet to show sign of establishment, however the 2015 release of a stem-galler at Athabasca showed survival with the presence of nine galls this year. On the horizon are biocontrol agents for common tansy and oxeye daisy, as testing continues in Europe.

Marian Jones—Rocky Mtn. House Forest Area

What's the *BUZZ...about the fir coneworm moth*?

Fir coneworm moth. Photo: Ward Strong

The fir coneworm, *Dioryctria abietivorella*, could be considered another one of those little grey moths. However, I think that this is a really interesting little grey moth! Keep in mind that I'm biased since this critter was the focus of my graduate research. You can imagine the hardship I suffered studying this moth in north Okanagan seed orchards for three years ….

The fir coneworm is a generalist and infests most coniferous tree species throughout its range in North America. Larvae tunnel through cones and feed on the seed within, typically destroying an entire cone , and may migrate to another cone to continue feeding. Not only can the fir coneworm infest a wide variety of tree species, they are able to feed on different types of tree tissues. Feeding occurs in cambial tissue of graft unions, stem and branch galls. Fir coneworm larvae may also feed on needles and shoots although these are nutritionally suboptimal.

Fir coneworm larva feeding in spruce cone. Photo: British Columbia Ministry of Forests, Lands and Natural Resource Operations.

In the north Okanagan, larvae at varying maturity stages are found in cones at the same time and adults are trapped throughout the growing season. By late summer, late-instar larvae exit the cones to overwinter as pupae in the duff layer beneath the host tree. We're uncertain how many generations occur in a year due to this overlap in larvae instars and the presence of adults throughout the summer. It may be that there are two distinct generations, or the prolonged development of a single generation. It could also be that there are two developmental pathways that larvae could undergo: one path that leads to larvae completing a full lifecycle in one year while the remainder of the population halts development mid-season to enter diapause and overwinter.

This moth typically isn't considered to be a forest pest in natural settings but the story changes in managed environments such as seed orchards. In orchards trees are managed to increase seed quality and quantity as well as to decrease cone-crop variability between years. This provides an abundant and consistent food supply that allows fir coneworm populations to remain relatively high. In addition to this, fir coneworms can switch host species which allows them to cope with years of low cone production in the orchards. Not only do larvae destroy seed cones before harvest, they continue to feed in stored cones which causes further economic losses.

Frassy evidence of fir coneworm feeding in Douglas-fir cones. Photo: D. Manastryski.

Fir coneworm infestations can be monitored in a couple of different ways, each with their own complications. Repeated examinations of cones throughout the growing season can be used to determine infestation rates. Other species of insects and *Dioryctria* infest cones and so correct species identification can be tricky but is essential for infestation rate calculations. Male moths are monitored using sex pheromone-baited traps placed within the upper canopy of orchards. Before this tool can be used by decision it must be determined if capture rates in pheromone traps can be related to larval densities and damage rates. Synthetic pesticides are the main

control strategy for managing fir coneworms. The use of pesticides is complicated by the fact that their effect on non-target species, as well as sub-lethal effects and secondary pest upsurges, has yet to be quantified.

There is much left to learn about the fir coneworm biology and ecology that will help seed orchard managers effectively control populations. Effective management will be achieved through a better understanding of its life history, interactions with other insects, and the ecological factors that promote the adaptive flexibility of the fir coneworm that underlies their economic impact.

Caroline Whitehouse—Edmonton

Marty Robillard Retires

Recently I spoke with Marty Robillard, Forest Health Technician, who has recently announced his retirement. Marty has been a valued member of the forest health team in Alberta for almost 14 years. His duties were primarily the surveying and detection of forest pests and the assessment of the health of forests across north eastern Alberta. If Marty was not out tromping around the bush, one could often find him busy counting insects, entering data, or mentoring staff.

Mike: *Marty, knowing that this wasn't your first job with the Alberta Government, can you tell me a bit about your work pre-forest health?*
Marty: My first job with the Province started in January 1978 at the Alford Lake Hunter Training Camp, south of Rocky Mountain House, as the Camp Manager. From there I went on to be a Hunter Education Officer in Calgary serving both Southern and Central Alberta. After that I became a Fish and Wildlife Enforcement Officer stationed out of both Calgary and the Elbow. I took a buy-out package in 1996 to "spread my wings." Various jobs followed, including managing a trout farm, selling sporting goods, 6 months in northern Texas working with the Hunter Training program there, running the Hunter Education Camp at Narrow Lake west of Athabasca, bee-keeping, painting bridges, and working at a garbage/recycling facility. It was all very interesting and I learned a lot.

Mike: *Looking back at your current position, what would you say was your best day on the job?*
Marty: There wasn't really a "best day." There was many, many best days. The best days were probably the "learning" days when working with other staff out in the field. The knowledge exchange, the professional comradery, and the different perspectives made those days special. On somewhat more of a personal level, there were a few field days when at lunch I asked the pilot to set me down at the river while he went to fuel up. Those times were totally enjoyable; so peaceful and relaxing.

Mike: *On the flip-side, did you ever have a bad day on the job?*
Marty: Hands down it was July 10, 2012. On that day I hit the top of some spruce trees with a Cessna 206 in the Clearwater Valley east of Ft. McMurray while conducting a spruce budworm aerial overview flight. After scraping the trees we quickly looked for a soft chunk of muskeg to hit. Fortunately the pilot gained enough control of the damaged plane to make an emergency landing at the Gordon Lake Airstrip. SCARY as in S-C-A-R-Y!

On July 25, 2016, I finally got the nerve up to try aerial surveying again. This time I believe we were in a Cessna 210. Shortly after taking off from Ft. McMurray I heard the pilot say “we have to get this plane on the ground now.” I looked up from my laptop and there was oil all over the windshield. We did an emergency turn-around and made it back to Ft. McMurray without incident. I subsequently asked to be taken off the project, and have not been in a small fixed-wing since then.

Mike: *What will be keeping you busy once retired?*
Marty: Right now I feel like I need to spend more time ‘smelling the trees.’ I have been too busy at too many things. I need to take a bit of time to re-learn how to relax. Once that is accomplished, I have a company called License Plates and More that could be taken up 2 or 3 notches quite easily. The focus of the company is selling antiques and collectables, with an emphasis on license plates. Presently I have an eBay store and also set up at a few car shows per year. My name is fairly well known within the “license plate community.” Soooo… if you have a lot of old license plates, now you know where to get rid of them. But who knows what may happen. I may take some work here and there...I know I have some ‘old-timer’ skills that sometimes technology cannot replace.

Mike: *What do you anticipate as the biggest challenge the forest health program will face in the near future?*
Marty: Invasive species, both plants and animals, will likely continue to increase in both numbers and distribution. Obviously the impact on the environment is somewhat unknown.

Mike: *Over the past years you must have developed a fondness for at least one forest health damage agent?*
Marty: No question - forest tent caterpillar. They are such amazing creatures as both individuals and as a natural recycling agent.

Mike: *Any parting words Marty?*
Marty: Work safe, work hard, and ENJOY! Don’t always be in a rush - slow and steady wins every time. Look after yourself, your family and your friends. Remember you are important as an individual and as a part of the team. Congratulate others on their victories, but just as important be compassionate and caring when needed. Always practice listening skills. And don’t be scared to stand up for yourself - if your senses tell you something is wrong, it likely is wrong. To my co-workers, please accept a heart-felt “Marty” thank you. It has been a pleasure to work alongside a wonderful bunch of folks.

Mike: *Well Marty, thanks for taking the time to chat, and the best of luck as you start on your ‘new journey.’*
Marty: You bet. Thanks Mike

Happy Retirement Marty!!

Mike Undershultz — Edmonton

A Gift of Trees

For two beautiful days in early October, 11 lucky people got to channel their inner dirty tree planters to install a provenance trial of limber pine in a burn just east of Banff. This site burned twice: 2009 and 2014, reducing competitive brush. Woody debris makes great microsites for limber pine and keeps OHVs out.

The seeds came from 30 populations from Alberta to New Mexico, represented by 145 trees. This valuable collection was too precious to waste. After Barb Gass, MSc student at UBC, was done assessing these limber pine seedlings grown at the UBC greenhouse, Barb and her supervisors, Dr Amy Angert (UBC Botany, Vancouver) and Dr Anna Schoettle (USDA Forest Service, Colorado), decided to give them a second life.

Forest Health Officer Pam Melnick assembled a crack team from Rocky Mountain House and identified the trial site, Dr. Amy Angert sent a crew from UBC, Denyse Dawe, who is beginning a Masters project on limber pine at Kings University, came out to help, Christine Holtz from the USDA Forest Service in Colorado flew up with an amazing array of equipment that she somehow got through airport security, and Jodie Krakowski from Forest Health & Adaptation in Edmonton rounded up planting gear.

The seedlings are now planted in two provenance trials, one in Alberta and one in Colorado. A provenance trial is a long term field study testing seed sources from different locations. This allows us to measure how different populations are from each other, and how similar or different trees within a population are. These trials are used to determine how far seeds can be moved for reforestation before they become maladapted to the climate at the planting site.

Because limber pines grow really slowly, this is a long term project, looking at how populations differ in survival, growth, cold hardiness, budburst and budset, and other important adaptive traits from their northern to their southern limits. Some of these seed sources have also been tested for white pine blister rust resistance, adding extra value to the trial. Next year the trees will be checked for survival, and traits will be measured every 3 to 5 years after that.

Jodie Krakowski - ATISC

Mountain Pine Beetle Open House in Hinton

Alberta Agriculture and Forestry, West Fraser, and the Town of Hinton organized and hosted a Mountain Pine Beetle (MPB) Open House that was held on Wednesday October 12, 2016 at the Hinton Community Centre. Representatives from Yellowhead County and fRI Research were also present.

Currently in the Hinton and Jasper area we are experiencing the largest population of MPB to date. A MPB outbreak started in British Columbia in the early 1990s. Since that time the insect has killed approximately 50% of the total volume of commercial lodgepole pine in that province. While isolated records of MPB had been noted in Alberta before, it was the large

migration of beetles from British Columbia in 2006 and 2009 that has since fueled the spread into Alberta.

During the MPB Open House West Fraser representatives were present to talk about current harvest plans for areas in close proximity to Hinton (e.g. Seabolt Road, Cold Creek Road, Solomon Creek). Information regarding the status of MPB in Jasper National Park was also available.

FHO Andrea Sharpe (L) and FHT Caroline Charbonneau.

Many members of the public concerned about MPB came out to learn more regarding MPB identification and West Fraser's and the government's plans for what is currently being done in the local area this year. Maps were available showing historical information on MPB locations and current conditions within the Edson Forest Area.

Overall this event was well received by the public. Some of the feedback we received: many were glad to see government and industry working together to combat this problem locally, and the information on current conditions and ongoing research was valuable.

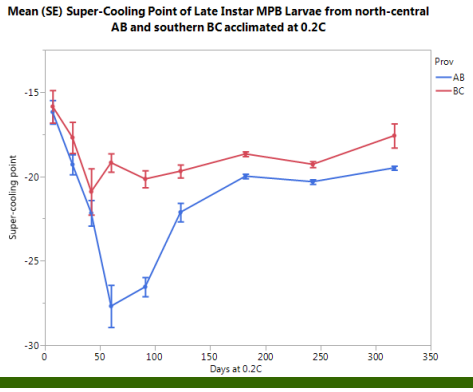
Andrea Sharpe - Edson Forest Area

A Good time to be a Bark Beetle Biologist in Western Canada ...

...if it's not one beetle, it's another.

The main on-going project in the Bark Beetle Biology Lab at the Pacific Forestry Centre is MPB Cold Tolerance. Many of you have helped with this project over the last few years. In fact, Jenn McCormick sent us a couple pallets of infested wood from Slave Lake this past March. The insects had lost their cold tolerance when they arrived in the lab, so we tested their ability to regain it. The short storey is: once larvae lose their cold tolerance, they can't seem to regain it to nearly the same degree. This would explain why you sometimes observe significant spring mortality when a warm spell is followed by a cold snap. We are currently running a follow-up experiment to narrow down the conditions leading to the loss of cold tolerance. (Did I mention we hauled 4,000 lbs of infested wood out of the bush in AB in September to do experiments with?)

Recently we completed an experiment examining the cold tolerance of MPB larvae from north-central AB and southern BC acclimated at different temperatures. We took infested wood from the field in September 2015 and put it at four different temperatures (~15, 6, 0.2 and -7.5□C) and measured the cold hardiness of late instar larvae over time. The best temperature for acclimation was 0.2□C. MPB larvae cannot "rapidly cold harden" over the course of hours or days; from the figure to the right, you can see that it takes them weeks to acquire their maximum cold tolerance. You can be proud of your AB larvae though, they were more cold hardy than larvae from southern BC by approximately seven degrees!



We recently published a degree day model for MPB flight in north-central Alberta in the scientific journal Environmental Entomology. We analyzed funnel trap data collected by Forest Health Officers in AB and predicted the timing of the flight based on degree days and latitude. This model could be used to predict the flight period of MPB at a given site in a given year based on temperature.

But, there are other bark beetles. I had the pleasure of seeing some eastern larch beetle with Pam Melnick (Rocky Mountain House Forest Area) in April, although she put me to work taking bark samples. And, there is spruce beetle! I'm currently in the process of developing a study to determine temperature thresholds or cues that allows their development to be completed in one year versus two years. Although the project has not officially started, we were able to jump start the field sampling part of the study in September thanks to Colton Briggs who led me to a suitable field site near Swan Hills

Greg Smith (L) and Kathy Bleiker picking spruce beetle out of bark samples at a field site near Whitecourt, September 2016.

I'd really like to take this opportunity to thank AB Agriculture & Forestry and the Forest Health officers for all their help and support with bark beetle research!

Kathy Bleiker, Research Scientist, Bark Beetle Biology
Natural Resources Canada, Canadian Forest Service

What is Bugging My Tree?

Noticing a conifer or deciduous tree is not looking healthy is easy but determining why is not. Forest Health Officers receive multiple inquiries from both industry and public asking for assistance in identifying the damage agent or agents affecting their trees. Several years ago, the now retired Alberta Forest Entomologist Sunil Ranasinghe, developed the Alberta Forest Pest Damage Diagnostic System.

This tool provides a database detailing host trees, symptoms, biology, impacts and images relating to forest pests in Alberta. The system has several useful tools for diagnosis and searches as it allows users to select tree species, tree height groups, location of damage on trees and observed symptoms. Once a probable diagnosis has been made, information regarding pest distribution, biology, and impacts are listed.

In the new year, FH&A will be looking at the system and determining how we can update the tool to add more pests and information. But, in the meantime, if you need help diagnosing what is bugging your tree, visit:

http://albertaforesthealth.com/

Erica Samis - Edmonton

Northern Tent Caterpillar—Part One

North America hosts six species of tent caterpillar (Lepidoptera: Lasiocampidae)[1,3]. Some species such as the forest tent caterpillar (*Malacosoma disstria* Hubner) and eastern tent caterpillar (*Malacosoma americanum* (F.)) are easily recognizable due to these species causing repeated, large-scale forest defoliation events that have notable impacts on forest ecosystem dynamics[1,3]. Other species of tent caterpillars are less well-known due to these species having a limited distribution, lower economic impact, or because they tend to be less problematic at large spatial scales[1,3].

One sub-species of tent caterpillar that is less commonly recognized is *Malacosoma californicus pluviale* (Dyar), which is one of six sub-species (plus other unclassified forms) of the western tent caterpillar *Malacosoma californicus* (Packard) complex[2]. In Canada, northern tent caterpillar is the common name given to *Malacosoma californicus* pluviale[3,4,5], while in the U.S.A. western tent caterpillar remains the general common name[2,3]. In this article, I will refer to *Malacosoma californicus pluviale* as the northern tent caterpillar (NTC).

In Canada, the NTC can be found throughout the southern half of British Columbia, most of Alberta, Saskatchewan, and Manitoba, and the southern portions of Ontario and Quebec. In the U.S. NTC is found throughout the Pacific Northwest with isolated pockets found in Minnesota, New Hampshire, and New York. The range of NTC is a well-defined portion of the large distribution of the western tent caterpillar complex that includes a diverse set of habitats throughout northern Mexico, the western U.S.A. including the southwest states, the Great Plains, and the Pacific Northwest (Fig. 1). The western tent caterpillar complex has one of the largest distributions of any *Malacosoma* species in North America[1,2,3,4].

Fig 1. Range of WTC and NTC.

Host species of NTC vary with geographic region but include hawthorn, hazel, birch, ash, pin cherry, choke cherry, aspen, alder, willow, black cottonwood, wild rose (Rosa spp.), wild currant, bitterbrush, and various fruit trees[1,2,4,5].

Fig 2. NTC egg mass.

Female moths oviposit in clusters containing 150 – 250 eggs. Clusters are approximately 15 mm wide and partially encompass a small twig or branch. The female then deposits a foam-like coating over the eggs called spumaline, which hardens to form a protective coating over the eggs. Spumaline may be dark brown to pale grey in colour (Fig. 2)[2,4].

Newly hatched larvae are 3 mm long, uniformly dark brown or black, and sparsely covered in white hairs. Larvae will mature through five instars, reaching 45 – 55 mm long at maturity. In general appearance, the fully-grown larvae appear predominately black and orange, or black and yellow (Fig. 3)[2,4,5].

Fig 3. Mature, late instar NTC

Pupae are typically a dark reddish brown colour, 15 – 20 mm long (Fig. 4), and found within an oval silken cocoon covered with fine white or pale yellow dust (Fig. 5). Just prior to pupation, NTC larvae may leave the host tree in search of a suitable pupation site. Most often, however, pupae are located on branches of the host tree or inside of protective structures consisting of several leaves tied together with silken thread (Fig. 6)[2,4,5].

Fig 4.NTC pupal case attached to leaf.

Fig 5. Silken cocoon of forest tent caterpillar.

Young larvae are fully developed within the eggs 3 – 4 weeks after being laid. Instead of hatching and exiting the eggs in the autumn, the young larvae remain within the egg case to overwinter[2]. Larval emergence the following spring coincides with the onset of bud break of its host trees[2,4]. Shortly after emergence the young larvae collectively construct a silken tent. Larvae from multiple egg masses may construct a single tent. Typically, tents are most numerous on the south and west aspects of the host tree since these aspects are preferred for egg-laying[6]. Young larvae feed gregariously within the tent. Larvae will enlarge the tent as they develop and increase in body size. The tent provides protection from predators and inclement weather as well as a safe site where the early instars can molt between successive growth stages.

Fig 6. Silk and leaf structure containing NTC pupa.

Once the larvae have reached the fourth or fifth instar, they leave the tent and become solitary feeders[2]. Warm, dry weather favours larval development. Larvae develop from first to fifth (final) instar in 30 – 42 days such that feeding is largely complete by late spring or early summer[2]. Most of the defoliation on host trees is due to feeding by fifth instar larvae. Once larval feeding is complete, the larvae create silken cocoons on the branches and within remaining foliage. Pupation lasts for 12 – 18 days[2]. Adult moths emerge from the pupae in late July or early August completing the life-cycle.

Part Two of this article (April 2017) will focus on previous outbreaks, natural enemies, and control methods for the northern tent caterpillar.

Fraser McKee—Lac La Biche & Ft. McMuray Forest Areas

Photo credits

Fig. 1 – Ciesla, W.M. & Ragenovich, I.R. 2008. Western tent caterpillar. Forest Insect & Disease Leaflet 119, USDA Forest Service.
Fig. 2 – Whitney Cranshaw, Colorado State University, Bugwood.org
Fig. 3 – Jerald E. Dewey, USDA Forest Service, Bugwood.org
Fig. 4 – Ciesla, W.M. & Ragenovich, I.R. 2008. Western tent caterpillar. Forest Insect & Disease Leaflet 119, USDA Forest Service.
Fig. 5 – Whitney Cranshaw, Colorado State University, Bugwood.org
Fig. 6 – William Ciesla, Forest Health Management International, Bugwood.org

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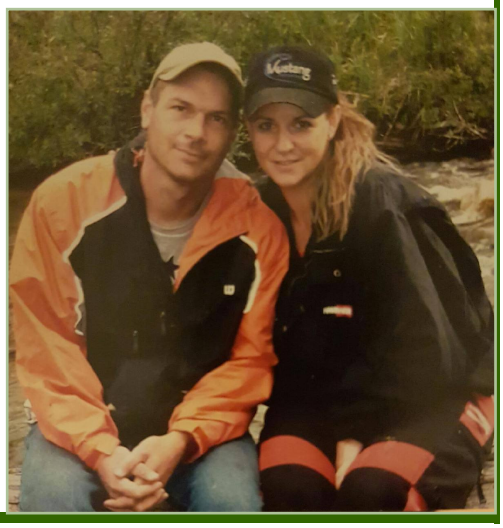
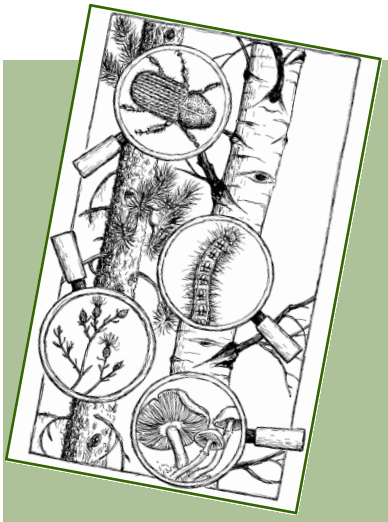
Remembering Denise Galley

Denise Galley was a long-term contractor working with mountain pine beetle. She and her husband Al first began working in the MPB program over 10 years ago. Together they worked on all aspects of the mountain pine beetle program from ground surveys, quality inspections, instructing, and working with municipalities.

Every year around 1000 hours are logged in helicopters by both Forest Health staff and contractors detecting the newly fading trees. Denise particularly loved the annual aerial survey and seeing the country from a helicopter. She was a gal that loved the bush and her loss will be felt by any and all who are involved in the provincial program. At the same time, anyone who knew Denise can't help but smile when they think of her. That happy girl who always looked like a million bucks, no matter how far out in the bush! Denise, you were truly unique and you are missed.



Denise is survived by her husband, Al, and her three children.

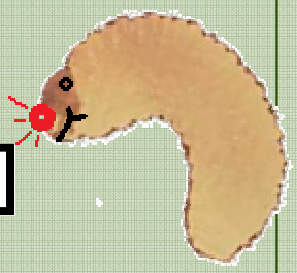


Rudolph the Beetle Larva

There are billions, or trillions of MPB larvae
Through phloem of susceptible pine they do carvae
But does anyone actually recall
The most famous larva of all

Rudolph the beetle larva
Wore a grin from ear to ear
He didn't think cold weather
Was gonna come again this year
All of the other larvae
Were pretty optimistic too
They had sufficient glycol
(or so they thought) to see them through

Then one frosty Christmas Eve
Santa came to say
Rudolph you won't like your plight
It's gonna get mighty cold tonight
Then all the beetle larvae
Experienced a night chilly
Many, like poor ol' Rudolph
Found that they were history!



Listen Here
As performed by Tommy-Teneral and the Instars

Tom Hutchison—Edmonton

Forest Health Officers:
Bart McAnally - Acting
Calgary
403.297.8846
Bart.McAnally@gov.ab.ca

Andrea Sharpe
Hinton
780.865.6992
Andrea.Sharpe@gov.ab.ca

Jennifer MacCormick
Slave Lake
780.849.7409
Jennifer.MacCormick@gov.ab.ca

Devin Letourneau
Grande Prairie
780.538.5609
Devin.Letourneau@gov.ab.ca

Pam Melnick
Rocky Mountain House
403.845.8277
Pam.Melnick@gov.ab.ca

Ryan Hermanutz
Peace River
780.624.6448
Ryan.Hermanutz@gov.ab.ca

Colton Briggs
Whitecourt
780.778.7213
Colton.Briggs@gov.ab.ca

Fraser McKee
Lac La Biche
780.623.5393
Fraser.Mckee@gov.ab.ca

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